Effect of Bioclimatic Features on the Performance of Daylight in Selected Private Hostel Buildings in Obafemi Awolowo University Ile-Ife, Nigeria

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Abstract

The study examined the effect of bioclimatic factors on the performance of daylight in selected private students' hostel buildings in Obafemi Awolowo University Ile-Ife, Nigeria. The study assessed the daylight performance of hostel buildings; examined occupant satisfaction with daylight performance; assess the effect bioclimatic features on the performance of daylight with a view to reducing dependency on artificial lighting in hostel buildings. Quantitative data were obtained through objective measurement for both indoor and outdoor illuminance of the selected hostels using light meter. Qualitative measurement was used to examine the occupants satisfaction with daylight in students' hostel, field observation was used to assess the effect of bioclimatic designs on the hostels daylight. Data was analyzed using description, code, percentage and content analysis. The results of field measurement shows that the indoor illuminance ranged between 0.17lux and 986lux, while the calculated daylight factor ranged between 0.0008 and 2.05%, which implies that the illuminance level of the selected hostels is considerably poor when compared with CIBSE lighting guide 10 which recommended that the minimum illuminance for study room should be between 300-500lux, only AP hostel met the standard daylight performance (1.62 and 2.05). The result also shows that buildings oriented towards the east and west directions have better indoor illuminance (11.24 to 986lux) and better daylight factor (0.022 to 2.05) compared with north and south direction. The result of qualitative measurement shows that 62% of the respondents agrees that natural lighting is adequate while 38% of the respondents opined that natural lighting is not adequate. The result of bioclimatic designs shows that building forms, layout, orientation, courtyards, light shelves, screen wall, green environment, corridors and shading devices were major bioclimatic design features initiated in the hostel buildings, but only BVRE, AP and Rock of Ages hostels demonstrated a better daylight due to the integration of courtyards, light shelves and green environment. The study concluded that the illuminance level is not adequate but however, recommended that future designs of private hostel buildings should integrate bioclimatic design features such as building layout, courtyard, light shelves and green areas and to also educate design practitioners on the need to integrate daylight parameter in hostel designs.

Keywords: *Bioclimatic, Performance, Daylight, Private, Hostel Buildings*

Introduction

Lighting is an essential need in modern buildings because it enables the extension of indoor activities beyond sunset and also ensures security and safety around rooms and as well as internal environment of the buildings (Shashidhar and Rajitha, 2015). Daylight had been proven over the years as a prominent way of providing lighting into buildings. Daylight in buildings is a practice of bringing light into a building through windows, skylight, roof light, and light shelves distributing it in a way that provides more desirable and better-quality illumination than artificial light source (Kumar and Blangala, 2020; Lam, 2003). However, daylight performance is an effective way of designing buildings to harness and utilize natural daylight to illuminate interior space of a building. The performance of daylight in buildings have tendency of reducing the need for electrical light source, thus minimizing electricity use and its associated operational costs and pollution. Studies have substantiated that daylight create healthier and a more stimulating work environment than artificial lighting systems and increase productivity (Kumar and Blangala, 2020; Lam, 2003).

Studies have also shown that a properly designed and implemented daylight strategies can save 50 to 80 percent of lighting energy (Moore, 2004). Greater use of daylight can also provide advantages for the environment by reducing electricity demand, related pollution and waste by-products from power production (Moore, 1991). In the United States, the greatest savings from daylight occur during period when sunlight is most intense, which coincides with periods of peak demand for heating, ventilating and air conditioning (Aries, 2008). Therefore, while designing room daylight, building designs and materials have a significant effect on lighting intensity (Aksamija and Ajala, 2013). It is of great importance that building orientation, optimized window size and daylight harvesters, such as courtyard, foyer and trees among others are some of the bioclimatic design parameters that could ensure a more efficient daylight factors (Adeleke et al., 2022; Olanipekun, 2017 and Dahlanet et al., 2009). Other significant factors when designing buildings is by introducing solar radiation, shading devices, glazing type, window disposition, location in relation to parts of the world, time of the day and year (Yarramsetty et al., 2020; Olanipekun, 2017).

Studies had also established the correlation between daylight and students' performance. Daylight has psychological benefits associated to daylight in students’ hostel which includes improved eyesight and improved immune system. Thomas Benton claims that students who have spent more than a year in school feels better mentally and physically in a better daylight environment (Bailey, 1998). Hostels are type of accommodation that offers affordable, shared or dormitory-style lodging often with communal facilities. They are primarily occupied by boarders who live in academic institutions. Studies have also showed that the quality of hostels is capable of influencing students’ academic performance in schools (Meir et al., 2009). The primary purpose of hostel buildings is to meet varying needs and demand serviced with qualitative day and artificial lighting, ventilations, fire safety and better indoor environment meant to provide hygiene and pleasantness (Adewuni et al., 2011). However, the desire for quality of hostel and its facilities in terms of lighting, ventilation, and indoor environmental quality had become a nightmare for students living in public hostels particularly in developing countries like Nigeria (Adamu and Shakantu et al., 2016). These challenges had led to the establishment of private hostel buildings by individuals across campus in the country. One of the challenges is inadequate, uneven, epileptic and erratic power supply which had affected the reading culture and academic performance of students in schools. Employing daylight strategies is an effective way to overcome the current energy challenges in private hostel buildings. Pilot studies have shown that current designs of private hostel buildings are not keen in incorporating daylight into designs. Daylight as a valuable natural resources and its cost effective cannot longer be ignored as a means of illuminating buildings. Similarly, private hostel buildings often priotized functional and economic considerations over occupant comfort and well-being, leading to inadequate delighting and uncomfortable indoor environments.

However, despite the proliferation of artificial lighting to replace daylight in hostel buildings, the country is facing decades of long challenge of power supply that had led to the reduction in productive hour of the students reading habits and other academics activities especially while in their private hostels. The consequence of this challenge could result to poor academic performance (Mohammed and Lateef, 2024). With the current trend of the energy crises in Nigeria, the implementation of daylight harvesters through bioclimatic design in hostel buildings seems to be a good option to overcome these challenges. Incorporating daylight into students’ hostels

could assist in making lighting available thereby increasing students' engagement in activities tangential to their academics' performance (Mohammed and Lateef, 2024).
Lapithis, (2018); Jamaludin and Nila (2011) argued that the bioclimatic design of buildings is a major parameter to enhance the performance of daylight in buildings. Bio-climatic design involves the process of creating buildings that works in harmony with the local climate to minimize the need for artificial lighting and promoting energy efficiency. Olanipekun (2012) examined the bioclimatic designs adopted while designing the office buildings in Obafemi Awolowo University Ile-Ife, Nigeria. The study concluded that the adoption of certain bioclimatic designs such as overhangs, foyers, window among others are the major reasons for the good performance of daylight in the studied buildings. Study on the total performance of three office building in Liverpool concluded that bioclimatic designs (passive designs) are crucial factor to the performance of daylight in the buildings. Bhandari et al., (2025); Faheem et al., (2022) suggested the benefits of daylight within a climate specific passive design such as overhangs, cross ventilations, south facing orientation glazed windows and shading devices. The study recommended a thorough study in the regions belonging to a highly developed West African countries, for which a considerable amount of research in the field already exists. However, there is lack of research on the specific effects of bioclimatic factors on daylight performance in private hostel buildings particularly in tropical climates, that is why this study investigates the current condition of daylight performance in private students’ hostel, assess occupants satisfaction with daylight in hostels, examined the bio-climatic designs features in the students’ hostel that enhances daylight performance of hostel buildings with the purpose of reducing the over dependency on artificial lighting and promoting energy efficiency in buildings. The study explore the daylight strategies and their effects on lighting level in hostel buildings for building designers in the study area.

Methodology

The study was conducted among selected private hostel buildings at Obafemi Awolowo University Ile-Ife. It is a government established institution located in Osun State. It is about 218 kilometres (135 miles) Northeast of Lagos and the population of 509,813 households within the geographical coordinate of latitudes 7°31'N and 7°34'N and longitudes 4°30'E and 4°34'E. Areas selected for the study include Oduduwa Estate, Ede Road, Ajebandele, Koiwo, Parakin Asherifa, AP, Oronna, Ijedu, these were selected due to the hostels proximity to the campus and due to large significant percentage of students living within the area. The study adopts field measurement to assess the daylight performance of indoor and outdoor illuminance of the studied hostels, occupant opinion and field observations on the bioclimatic design parameters to measure daylight performance in the studied hostels. Pilot survey conducted shows that there exist only (32) private hostels in these locations out of which nine (9) were purposively selected for the study out of twenty (22) hostels that met various design criteria among others which includes orientation towards the sun-path, mode of construction, gender specific, wing of hostels and willingness of the occupants to grant access to their rooms. Questionnaires were administered to assess the level of satisfaction with daylight performance. A total of two hundred questionnaires were administered to target respondents out of 400 targeted population representing 50% within December 2024-February 2024 during harmattan period. The outdoor illuminance and indoor illuminance were measured using the light meter (Extech LT300) to take readings. The readings were taken from 12noon-4.30pm daily with an interval of one hour alternately repeated for the randomly selected hostel rooms. This was necessary to capture the different conditions and rapid environmental changes at different times of the day. All measurements were taken at a height of 0.8m above the ground level, which represents the height of the occupant at seated level. Readings for the indoor illuminance was taken at far left close to the window, far right close to the window and the middle of the room and the average illuminance was used for analysis. Table 1 shows the number of randomly selected hostels used for the questionnaire administration.

Results and Discussion

Daylight Performance of Hostel Buildings (Quantitative Approach)

The quantitative measurement was analyzed using the daylight factor, which is the ratio of the indoor illuminance to outdoor illuminance. The results of field measurements show that the indoor illuminance ranged between 0.17 and 986 lux, while the calculated daylight factor ranged between 0.0008 and 2.05%, this implies that the illuminance level of the studied hostels is considerably poor when compared with CIBSE lighting guide 10 (LG10- 1999) which is the expected daylight factor for ordinary seeing tasks which includes reading and easy office work is 1.5-2.5% and for moderately difficult task which includes prolonged reading, stenographic work and normal machine tool work is 2.5-4.0%. Similarly, the recommended daylight factors for bedroom, typing, computing room and living room should not be less than 0.5%, 4% and 1% respectively. Again, the CIBSE lighting guide 10 (LG10-2004) broadly bands average daylight factors into the following categories: not adequately lit, artificial lighting is required, adequately lit, artificial lighting may be needed part of the time, well lit- artificial lighting generally not required, except at dawn and dusk but glare and solar gain may cause problem.

Daylight Performance of Hostel Buildings (Qualitative Approach)

Similarly, the qualitative measurement was analyzed using content analysis for the data generated from observation and walkthrough. It involves inferring from the observed bioclimatic designs and stating their implications as regards natural delighting for each selected Hostels. Fine-touch Hostel is a one storey hostel accommodating 120 students located at the eastern part of Oduduwa Estate off Ede road Ile-Ife. It has a 2.7m high fence wall with landscape compound pavement bricks. The hostel has a courtyard arrangement and the floor area for each room is $12m^2$ with $2.1m^2$ balcony. The Balcony was screed with cement mortar, the wall painted brown and the ceiling of the balcony was painted white. All the rooms have their own convenient as and kitchen, the floor is furnished with grey tiles, most of the rooms were painted in cream color paints in but only rooms were painted in brown and pink, the ceiling is finished with white paint. The study was carried out around 12-3pm. The mean outdoor illuminance was calculated to be 51.000 lux. The mean illuminance for two room 58 and 67 in the north was 9.68 lux and 0.17lux respectively. The daylight factor was calculated to be 0.020% and 0.0034%. The mean daylight actor for rooms was calculated to be 0.0670. The performance of daylight in the hostels is not adequate and therefore artificial lighting would be needed, since the daylight factor values were all below the targeted mean value of 1% for rooms which serve the purpose of living room and bedroom. The studied rooms are used as a learning place for students, and as such, the mean daylight factor should not be less than 1%. Herewith, one could conclude that the illuminance level in Fine-touch hostel rooms are poor due to poorly harvested day light for the hostel.

Rock of Ages hostel has a three bungalow blocks located in the northern part of Maintenance hostel off Ede Road Ile-Ife. Each block has a total of 12 rooms. It accommodates 70 Students, the floor is finished with ordinary cement mortar and the ceiling painted white. The rooms have an area of 16.5m each. The working height of the rooms is measured to be 3.5m. The wall of the rooms was painted with ash colour, floor finished with light cream tiles, ceilings painted white. There is no provision for convenient for each room however, there is a provision for convenient, kitchen and washroom for each building. The convenience has two windows with each located opposite each other, the window sizes of $0.81m^2$ each, both leading to the balcony at the back and front of the rooms, a room in each of the 3 blocks was studied. The blocks were labelled A, B and C. The study was carried out around 2:00-4:00pm in the afternoon. The outdoor illuminance was recorded to be 47,000 lux. The mean indoor illuminance for the rooms Room A12, B4 and C1 in block A, B and C was randomly selected and recorded to be 1.89 lux, 11.25 lux and 7.5 lux while the mean daylight factor for each room was calculated to 0.002%, 0.022% and 0.012% respectively. These illuminance values recorded and calculated are very low compared to the recommended values. This is partly due to the smaller windows to wall ratio of the external walls which is calculated to be less than 0.1 or 10%. The balcony of each block is provided with screen wall to serve both as shading device as well as providing access for ingress for daylight as also reduced the amount of illumination received through the windows into the rooms.

Adejare hostel is a single storey building located at Ijedu, Lagere Ile-Ife. The building has a court yard in the middle, the floor area of the balcony is screed and was measured to be $1.5m^2$, the wall painted brown and the ceiling was painted white. The floor area for each room was measured to be $9.0m^2$ while the working height for daylight was measured to be 3.0m. The rooms were finished with light cream tiles for the floors, ceilings painted white and purple paint for the walls with the exemption of few rooms painted with blue and yellow. A single window of area l.080m² leading into the balcony. The study was conducted around 1:00-3:00pm in the afternoon. The mean outdoor illuminance was calculated to be 50.000lux, the mean indoor illuminance for the three rooms were 5.82lux, 5.4lux and 11.50lux while the mean daylight factor was calculated to be 0.012%, 0.011% and 0.0229% for room 6C, 9A, and 8B respectively. These illuminance values recorded and calculated are very low compared to the recommended values. This is partly due to the smaller window to wall ratios of the external walls which is calculated to be 12% which is less than 20% and provision of just a single window for the rooms. The purple paint also lowered the reflectance value and thereby limiting the room illuminance.

Olateen hostel is a storey building located at the western part of Oduduwa Estate off Ede road Ile-Ife. It has just two rooms in the ground floor and 8 rooms on the first floor. The room arrangement is a typical face and face arrangement with a balcony width of 2.1m. The floor of the balcony was finish with floor screed, light cream colour for the wall and white paint for the ceiling. The area of each room was calculated to be 10.8m². Each room has a window wall area of 9.0m and a single window area of 1.80m². The study was carried around 2:00pm and the mean outdoor illuminance was measured to be 50,000lux and the indoor illuminance of the only room that was measured 160 lux while the mean daylight factor for the room was calculated to be 0.32%. The calculated mean daylight factor was low compared to recommended value of 20%. It was observed that the window was oriented towards the east which requires provision of shading devices to reduced glare caused by the direct sunlight thereby reducing the dependency on natural sunlight.

AP hostel is a storey building located at kojwo area Modakeke Ile-1fe. The hostel has a courtyard arrangement provided with 2.1m high fence. The hostel has a total number 20 rooms which accommodate 32 students, floor of the balcony is measured to be 1.8m, finished with light cream colour tiles, wall painted with light cream, with finished PVC ceiling. Each room has a window wall area of 8.4m and a single window of area 1.92m². The study was carried out around 1:00-3:0pm and the mean outdoor illuminance was measured to be 48,000 lux and the mean indoor illuminance for the two rooms on the ground floor (A) and first floor (B) was measured 778lux and 986lux and the mean daylight factor was calculated to be 1.62% and 2.05% for the two rooms respectively. The shows that higher indoor illuminance factor was recorded because the ratio of window area to wall was calculated to be 22.85% even when the rooms were provided with a single window. The light shelve that was provided in an alternate position to the window, light cream paint provided a high reflection and window that was oriented towards the north south direction reduced the glare and the daylight performance. Since the mean daylight factor calculated is more than the recommended value. It could be concluded that the performance of daylight in AP hostel is adequate.

Varsity hostel is a single storey purposely located at Parakin area off Ede Road Ile-Ife. The hostel was provided with a 2.1m high fence with courtyard arrangement. The hostel had 32 rooms which accommodates 60 students. The width of the balcony was measured to be 0.9m. The rooms were finished with light cream tiles, wall is painted pink and green and ceiling is painted white. The room area is calculated to be 13.5m, with each room provided with two windows facing each other with size $1.8m^2$ each. The ratio of window area to wall area was calculated to be 20% with one leading to the balcony and the other opened to open space. The study was carried out around 1:00-3:00pm. The mean outdoor illuminance was calculated to be 50,000 lux, the mean indoor illuminance for the studied rooms Al8 and BI5 was 108lux and 72.5lux while the mean daylight factor calculated was 0.22% and 0.15% respectively. The calculated value gives an indication that the performance of natural daylight in the hostel is poor, this is partly due to the obstruction of daylight by the 1.2m fence close to the window wall, bad reflectance of pink and green paint used on the wall. Also, room A18 had a better daylight performance compared with room B15, this is partly because room A18 is located on the upper floor enjoys less obstruction compared to B15 located on the ground floor.

BVER hostel is located on the northern part of maintenance hostel off Ede Road Ile-Ife. The hostel is a storey building provided with a waiting room, mini-supermarket and security room. The hostel has a courtyard arrangement, each room has a room area of 13.33m², finished with light brown tiles floor finish and the wall painted with cream colour. Each of the rooms has two windows directly opposite each other and the ratio of window to wall area was calculated to be 16%. Two widow walls with a size of 9.3m each, window sizes of 1.44m² each with one leading to the balcony and the other open space. The study was done l-4:00pm. The mean outdoor illuminance was calculated to be 0. 000 lux, the mean indoor illuminance for the studied rooms An and Ba8 the former in the eastern part of the hostel while the latter in the western part of the hostel was calculated to be 85lux and 77.8lux while the mean daylight factor was calculated to be 0.13% and 0.5070 respectively. These illuminance values are low compared to the recommended levels. This was partly due to the smaller window to wall ratios of the external walls less than 20%.

Peace hostel is a bungalow building with two blocks located at Asherifa Area, Ile-Ife. Each floor has 8 rooms each. The area of each room is calculated to be 12.96m^2, the floor is finished with light grey tiles, and the room is painted white and black, and the ceiling painted white. Each room is provided with two windows with each facing each other, the ratio of window area to wall area was calculated to be 17%. The two window sizes of 1.8m² each. The study was carried out around 11:00-1:00pm. The mean outdoor illuminance was calculated to 49.500lux, the mean indoor illuminance for room RM6 and RM2 with RM2 located in the block A and RM6 in Block B was calculated to be 160lux d 180lux while the mean daylight factor was calculated to be 0.32% and 0.36% respectively. The calculated value gives an indication that the performance of natural daylight in the hostel is poor, this is partly due to the obstruction of daylight by the fence which is around 0.6m close to the wall of the window and the smaller window to wall ratio of the external walls was less than 20%.

De Gold hostel facility is a single storey building located in the northern part of maintenance hostels of Ede Road, Ile-Ife. The rooms have an area of 12.96m^2 each. The working height of the rooms is measured to be 3.6m. The wall of the rooms was painted with dark purple, the floor finished with light cream tiles and the ceilings painted white. Two widow walls with a size of 10.8m each are located opposite each other, with window sizes with 1.08m each. The study was carried out around 2:00-4:00pm. The mean outdoor illuminance was calculated to be 50,000lux, the mean indoor illuminance for the rooms was 31.8lux and 0.38lux while the mean daylight factor was calculated to be 0.064% and 0.0008% respectively. The calculated value gave an indication that the performance of natural daylight in the hostel is poor, this is partly due to the arrangement of the hostel where little consideration was given passive designs.

Demographic Characteristics of the Respondents and Daylight features in Hostel Buildings

Table 2 show the detailed characteristics of the respondents. Out of the two hundred (200) respondents, male gender represents the least with 35.5% (71) while female gender is the highest with 64.5% (129). This implies that the females are more disposed to interact with since they are mostly available in the hostels. In the age column, 39% of the respondents were less than 20 years, 65.5% are between 20-35 years which is the highest percentage and the lowest is above 30 years. This implies that adult which were mostly students gave audience and provided important information for the study. Similarly, the table shows that 52% of the respondents spent more than 6 hours in the room daily, 43.5% spend 4-6 hours, 7% sped 2-4 hours in their rooms and the rest use less than 2 hours. This implies that more than average of the students spent above six (6) hours daily in their respective rooms. Findings from room type also shows that 59% of the respondents lived in single room apartment, 37.5% lived in doubled bedded rooms, and others lived in multiple bedded rooms, this also implies that single bedded room apartments are majority of rooms available in the study area. The results on the number of windows shows that 50% of the selected respondents agreed having between one to two windows in their rooms, 43% have one windows and 7% agrees having more than two windows in their respective rooms, this implies that most of the hostel visited have between 1-2 as built windows. Moreover, on the window positioning, 48.5% agrees that their windows are placed directly opposite to each other 51.5% agreed its windows are placed at alternate positions. Furthermore, issues surrounding turning on lights, 97% of the respondents agrees that artificial light are turn on mostly during evening and night-time while 3% of the respondents agrees that light is turn during the day when natural light is not adequate. On the activities carried out in the rooms, 46% of the respondent agrees working mostly with their laptops and phones, 38% agrees reading in the room while 16% agrees writing by hand. Occupants also rated the rooms lighting conditions and agreed that 19.5% of the lighting is good and the least percentage with 14% agrees the room lighting conditions is slightly bad. However larger percentage also agrees that lighting conditions in their respective rooms is bad. Similarly, the room lighting condition was also rated, 44% respondents agreed no change, 33.5% agrees it is a bit brighter, 18.5% agrees much brighter. Finally, 68% of the respondents agrees that sun is the major source of daylight in rooms, 15.5% agreed it is through surface reflectance and 34.5% and the highest percentage did not agree with either. This implies that natural lighting can be challenging in full strength when shedding devices are not properly used in design to harvest daylight in rooms.

Bioclimatic Design Features for Daylight Performance in Selected Private Hostels

Table 3 shows the bioclimatic design features and strategies for Fine touch, Rock of ages, Adejare, Olateen, AP, Varsity, BVER, Peace, and De gold hostel, particularly in the area of natural ventilation and daylight. The study identifies the bioclimatic design features such as building form and layout, orientation, wind, façade design, window size, courtyard, window to wall ratio, overhang, tinted window glass, light shelves balconies, roof top garden and green area as critical design factors that influence daylight in the hostel buildings. The outcome of the observation shows that Peace, Rock of ages and Oleeeen hostels were built as linear forms while the others were built as a courtyard arrangement. The built form configuration of Adejare, Alateen, Peace, and Fine-touch hostels are oriented to the sun path, which makes the buildings exposed to thermal effects. However, other buildings are not oriented towards the sun path which directly eliminates thermal effects on the buildings, while the location of openings (windows) are not with respect to the direction to provide access to cross ventilation. Thus, directly not persuading natural ventilation in the students' hostel.

Similarly, small fixed opening devices (light shelves) were set up in the staircase area in Fine-touch, BVER and De-gold hostels meant to promote the admittance of daylight but unfortunately was not sufficient to provide adequate air circulations and daylight along the balcony area. None of the roof design have rooftop gardens features because the hostels roofs are all pitched. The building layout that was based on a courtyard arrangement allows the wing walls on the top of the entrance door and wall to fully function in inducing air circulations and daylight to the interior of the balcony and rooms. As a result, the balcony lamps need not to be switched on during the daytime. Additionally, the buildings orientation to the sun path which are in north-south direction, which massively reduce the thermal gain in residential units to create better thermal environment.

The enclosure of façade design, only AP hostel provide each room with an additional light shelf to serve as daylight harvester. Adejare and Fine-touch hostels do not have windows that protects against glare as the window materials in metal and casement respectively. The occupants of the hostels results to the use of curtains rails to protect against glare, in Fine-touch hostel, most of the occupants always have their windows closed so as to protect themselves from glare thereby making the students less dependents on natural daylight as well as natural ventilation. Other hostels were designed with special features such as glare protection and adjustable natural ventilation options. The hostel provided with sliding type of windows with tinted glass, which offered the occupancies the possibilities to channel the air/wind, although the position of the windows and the building orientation are in accordance with the prevailing wind flow direction, southwest. Moreover, the amounts of daylight penetration can be controlled.

The Fine-touch hostel design provided the best energy conservation among the nine selected hotels in the study area, as each room was provided with its own prepaid meter and the occupants of the room are responsible the cost implication of energy used. The measures have so far made the occupants of the rooms energy conscious as it was observed that during the day, the artificial lighting is always put off and appliances like hot plate is not in use in the hostel, except for few occupants who are financially buoyant to afford AC. Similarly, other hostels utilized the measure of installing prepaid metering system however, it is not too sophisticated as that of Fine-touch hostel, Rock of Ages, BVER and De-gold hostels are the only hostels among the selected hostels that has provisions for green area. It was also observed that in most of the hostels and the rooms studied, energy savings bulb are widely used, this reduces the amount of energy consumption of lighting as compact fluorescent and light emitting diode lamps consumes less energy compared with incandescent lamps.

Additionally, the bio-climatic design features demonstrated by BVER include small courtyard arrangement which is open to the corridor which permits daylight penetration into the corridor and rooms of the hostel. The provision of fixed opening on the wall to provide the corridor and balcony daylight, green area of the hostel environment provides the occupants of the hostel with fresh ventilation. Similarly, the bio-climatic design characteristics of the Fine-touch hostel includes the provision of courtyard arrangement of the hostel brings daylight and ventilations into the interior spaces of the hostel, the used of prepaid meter provided for each room in the hostels allows the hostel users responsible for energy consumed. At the AP hostel, there is also the provision of light shelves and courtyard to allow access to delighting and natural ventilation into the interior and exterior spaces of the hostel, the available openings on the wall also provide access to daylight at the existing corridor and balcony. The bio-climatic features demonstrated at the Rock of Ages hostel shows that green area and large internal courtyard which allows daylight into the interior part of the building spaces of the hostel, the use of wall screen (fancy bricks) in the hostel also permits daylight into the corridor thereby bringing daylight into the interior spaces of the hostel. Contrarily, the bioclimatic features of De-gold hostel revealed the negative impact of not integrating or harvesting daylight and natural ventilation through either screen walls or courtyard. Table 3 shows the bioclimatic design features of each selected hotel buildings in the study area.

Table 1: Location of Hostels and the Percentage sampled

Location	Number of Hostels at various location	% of Hostels Selected	Number of Hostels Selected
Oduduwa area	8	25	2
Koiwo area	1	100	1
Lagere area	2	50	1
Maintenance area	14	21.4	3
Parakin area	3	33	1
Asherifa	4	25	1
Total	**32**	-	**9**

Table 2: Demographic Characteristics of the Respondents and Daylight features in Hostel Buildings

Variables	Options	Frequency	Percentage
Gender	Male	71	35.5
	Female	129	64.5
Age	Below 20 years	78	39.0
	20-25 years	121	60.5
	26-30 years	1	5.00
Hours Spent in the Hostels	Less than 2 hours	2	1.00
	2-4 hours	7	3.50
	4-6 hours	87	43.5
	More than 6 hours	104	52.0
Type of room lives	Single bedded	118	59.0
	Double bedded	75	37.5
	Multiple bedded	7	3.50
Number of windows	One	86	43.0
	Two	100	50.0
	Multiple	14	7.00
Position of Windows	Directly opposite each other	97	48.5
	Alternate position	103	51.5
Frequency of turning on light	During the daytime	6	3.00
	During the night time	194	97.0
Activities done within the room	Reading alone	76	38.0
	Writing by hand	32	16.0
	Working with computers	92	46.0
Rating of room lighting	Bad	36	18.0
	Slightly bad	29	14.5
	Neither bad nor good	31	15.5
	Slightly good	35	17.5
	Good	39	19.5
	Excellent	30	15.5
Sufficiency of natural lighting	Yes	124	62.0
	No	76	38.0
Room Day lighting condition	Much brighter	37	18.5

	A bit brighter	67	33.5
	No change	88	44.0
	A bit darker	8	4.00
Daylight Source in the room	Sun	68	34.0
	Surface reflectance	31	15.5
	Both	32	16.0
	None	69	34.5

Conclusion and Recommendation

The study concluded that the results of field measurements show that the indoor illuminance ranged between 0.17 lux and 986 lux, while the calculated daylight factor ranged between 0.0008 and 2.05%, given an indication that the illuminance level of the selected hostels is considerably poor when compared with CIBSE lighting guide 10 which recommended that the minimum illuminance for study room should be between 300-500lux. Similarly, only AP hostel met the standard daylight level with daylight performance (1.62 and 2.05). The results also show that buildings oriented towards the East and West directions have better indoor illuminance (11.24 lux to 986 lux) and better daylight factor (0.022 to 2.05) compared with North and South direction. The result of quantitative measurement shows that 62% of the respondents agrees that natural lighting is adequate while 38% of the respondents opined that natural lighting is not adequate and has resulted in students depending on artificial lighting to complement lighting particularly during the day and evening period to complement daylight.

The study recommended that to increase the performance of daylight in selected private hostel buildings:

2 Future designs of hostel buildings should integrate bioclimatic design features such as building form and layout, courtyard, light shelves and green areas to enhance the performance of daylight and ventilation.

3 Educate client and design practitioners on the positive effects and benefits of integrating day lighting in hostel buildings.

4 Encourage the use of good surface finishes with high reflectance for ceiling and wall surfaces in the design of hostel buildings.

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Table 3: Bioclimatic Design Features and Strategies for Daylight Performance in Selected Private Hostels Buildings

Characteristics	Adejare	BVER	Fine-touch	AP	Olateen	Peace	Varsity	De-gold	Rock of Ages
Form of building	Low-rise	Low-rise	Low-rise	Low-rise	Low-rise	Low-rise	Low-rise	Low-rise	Low-rise
Building Layout	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement	Courtyard Arrangement
Orientation to Sun path	W-E	N-S	W-E	W-E	W-E	N-S	N-S	N-S	N-S
Wind Direction of the locality	SW	SW	SW	SW	SW	SW	SW	SW	SW
Building Location on the ground	Same altitude	Same altitude	Same altitude	Same altitude	Same altitude	Same Altitude	Same altitude	Same altitude	Same altitude
Floor level Excluding GL	1	1	1	1	1	1	1	1	1
Typical Room Dimension LxBxH	3.6 x 2.4 x 3.0	4.3 x 3.1 x 3.0	4.0 x 3.0 x 3.0	3.6 x 2.8 x 3.0	3.6 x 3.0 x 3.0	3.2 x 3.2 X 3.0	4.5x 3.0 X 3.0	3.6 x 3.6 x 3.0	1.0 x 6.3
Typical rooms Floor area M^2	8.64	13.33	12	10.08	10.8	9.6	13.5	12.96	18.9
Typical room Volume	25.92	39.99	36	30.24	32.4	28.8	40.5	38.88	56.7
Design	Glare Protection and adjustable natural ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation	Glare Protection and adjustable natural Ventilation
Window Area (M^2)	0.81	0.81	1.8	1.8	1.8	1.8	1.8	0.81	0.56
Window to wall ratio	12%	12%	15%	20%	20%	18%	20%	10%	8.5%

Window design	Casement Window	Sliding Window With s shading	Casement Window	Sliding Window With s Shading	Sliding Window With s Shading	Sliding Window With s Shading	Sliding Window With s Shading	Sliding Window With s Shading	Sliding Window With s Shading
Location	N-S	N-S	W-E	W-E	W-E	W-E	N-S	W-E	N-S
Horizontal Overhang	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Vertical Overhangs Along the Walls with Windows	NIL	OK	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Tinted Window Glass	NIL	OK	NIL	OK	OK	OK	OK	OK	OK
Balconies Veranda	OK	OK	OK	OK	OK	OK	OK	OK	OK
Sky courts Internal Courtyard	OK	OK	OK	OK	NIL	NIL	OK	OK	OK
Articulated Light Shelves	OK	NIL	NIL	OK	NIL	NIL	NIL	NIL	NIL
Balconies Veranda	OK	OK	OK	OK	OK	OK	OK	OK	OK
Potential For rooftop Garden	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Green Area	NIL	NIL	NIL	NIL	NIL	NIL	NIL	OK	OK